NOAA SECTORAL APPLICATIONS RESEARCH PROGRAM (SARP)
PROJECT ANNUAL REPORT

PROJECT TITLE

Estimating the impacts of complex climatic events: the economic costs of drought in Colorado, Nebraska and New Mexico

INVESTIGATORS
(Research team and full contact information)

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PROJECT YEARS **3**

TIME PERIOD ADDRESSED BY REPORT *(e.g., August 2002-March 2003)*

July 2006 – March 2007

I. PRELIMINARY MATERIALS

This study focuses on the economic losses associated with drought. Drought occurs every year across different regions of the United States. The amount usually quoted for annual average economic losses in the United States due to drought is $6-8 billion (FEMA 1995). This number likely underestimates the actual impact of drought and certainly is not representative of the last ten years. Economic estimates of the impacts of past droughts have been difficult to produce and are likely to be either significantly higher or lower for any given year than the FEMA estimate. Drought is also possibly the only natural hazard in which the secondary impacts may be greater than the primary impacts because of the way they filter through the economy. Few or no official loss estimates exist for the energy, recreation/tourism, forestry, and environmental sectors. As the momentum for implementing mitigation strategies to reduce future drought impacts increases, it is evident that the United States needs a concerted effort to quantify the economic impacts of drought in order to understand the monetary benefits of these proactive risk mitigation strategies.

A Project Abstract *(Limit to one page)*

B Objective of Research Project *(Limit to one paragraph)*

The study will be developed as follows: (1) Determine the geographical level of the analysis (Colorado, New Mexico, Nebraska, and Wyoming) and the level of detail (e.g., local business and tax impacts versus broad categories like agriculture, manufacturing, recreation, etc.), which affects the way one interprets the input-output coefficients of the localized IMPLAN model (there may be no substitutes for an agricultural input creating large multiplier effects locally, but statewide there may be plenty of alternative sources of supply, so statewide multiplier effects in some cases may prove to be less important). (2) Identify and characterize significant droughts over the past ten years *(Hayes, Pulwarty)*. (3) Carry out interviews and surveys with key state agency and industry personnel on specific direct impacts of past droughts and impacts-reporting criteria for water tourism, agriculture, and wildfires *(Pulwarty, Hayes, Howe)*. (4) Identify and measure directly imposed economic damages (e.g., direct losses of value added in agriculture and damage to agricultural capital assets including tree crops). This will also include looking at issues such as how payments from federal crop insurance reduce damages as seen from a state viewpoint but not from a national viewpoint *(Supalla, Howe, Ding)*. (5) Identify and measure indirect damages in sectors linked to agriculture, energy and tourism. Lost value-added income in sectors linked to agriculture, for example, can be counted for short-run impacts *(Team)*.

The investigators will begin by examining recent droughts and the sectors affected in Nebraska, Colorado, and New Mexico, with an emphasis on the 2002 drought. This was one of the driest years for each of the three states over the past 100 years. This drought was embedded in the longer-term dry period that extended from 1999-2004. From this, a list of sectors particularly vulnerable to droughts will be developed for each state. Information about the economic impacts will be based from available data, as well as information obtained from telephone surveys and semi-structured interviews to be conducted with state-level department personnel in the Tourism, Agriculture, Natural Resources and Water sectors. In some cases, information will also be collected and assimilated from state-level representatives of some of the federal agencies as well, particularly within USDA. The project will begin to understand direct and indirect losses and work to identify and understand various economic loss estimation techniques available, with the hope of encouraging a standardization of estimates so that official can begin to compare “apples to apples”, and be able to make decisions based on these estimates. Finally, the investigators would like to identify and/or develop methodologies that could be used by officials in order to estimate drought losses in various locations, sectors, and geographic scales around the country.

The investigators anticipate a variety of results and benefits for both the public and the scientific community as a result of this project. First, this study will provide the opportunity to begin to answer some very specific questions related to drought impacts on individual sectors that have rarely been addressed such as the energy, timber, and recreation and tourism industries, and others. Second, this project will encourage the development of standardized methodologies for estimating economic losses from droughts at national, regional, state, and local scales. It will also assist in developing standard methods for identifying, collecting, and quantifying drought impacts at these scales as well. Third, this project will be a step toward the development of national and regional assessments of drought conditions across the United States. Finally, this project supports both the National Integrated Drought Information System (NIDIS) and the proposed National Drought Preparedness Act (2005). Both of these national initiatives call for better drought impact assessment methodologies in order to improve drought mitigation and response actions in the United States.

Mitigation and preparedness are the keys to reducing future drought impacts. But to provide officials with the information necessary to make decisions regarding drought mitigation, economic loss estimates need to be available. The Council of Governors' Policy Advisors noted that state officials are reluctant to dedicate money and resources to mitigation of any natural hazard unless these "hard" numbers are known (Brenner 1997). These state officials had a general understanding that "mitigation makes sense," but their desire was for quantitative proof. In fact, this report identified the "lack of information" as the major obstacle to adopting mitigation strategies. Similarly, the NSTC's (2005) "Grand Challenges for Disaster Reduction" document identified quantifying "the monetary benefits of disaster mitigation using economic modeling" as a challenge for developing hazard mitigation strategies and technologies. This project is a beginning step to overcome the "lack of information" obstacle and provide drought-related economic loss estimates and estimation techniques.

C Approach (including methodological framework, models used, theory developed and tested, project monitoring and evaluation criteria) include a description of the key beneficiaries of the anticipated findings of this project (e.g., decision makers in a particular sector/level of government, researchers, private sector, science and resource management agencies) *(Limit to one page)*

D Description of any matching funds/activities used in this project *(Limit to one paragraph)*

The National Drought Mitigation Center also has complementary funding through a grant provided by the USDA's Risk Management Agency (RMA). This RMA funding supports Ya Ding's salary, as well as a subcontract to the University of New Mexico that supports Janie Chermak there.

II. ACCOMPLISHMENTS

A. Brief discussion of project timeline and tasks accomplished. Include a discussion of data collected, models developed or augmented, fieldwork undertaken, or analysis and/or evaluation undertaken, workshops held, training or other capacity building activities implemented. *(This can be submitted in bullet form – limit to two pages)*

Accomplishments during the third/fourth quarters of 2006 (July-December):

- A workshop involving the project's participants was held at the University of Colorado in Boulder, August 17-18, 2006. The participants discussed the overall objectives of the project and began to think about short-term and longer-term tasks and responsibilities.
- On September 14, 2006, Chuck Howe and Chris Goemans sent out a document they developed, "A Strategy for Economic Drought Impact Measurement", to be used as a guide for the project's participants.
- Ya Ding, economist with the NDMC, began investigating a variety of indicators and data sources to attempt to identify the appropriate socio-economic baselines to use in drought economic impact assessments. Some of this work was presented at the National Integrated Drought Information System (NIDIS) meeting held in Longmont, CO, September 21-22, 2006.
- Several of the project participants at the University of Nebraska worked with Brad Lubben of the UNL Department of Agricultural Economics to determine the economic impact of drought on the agricultural sector in Nebraska for 2006. A report, "Nebraska Agriculture: Economic Impacts of Drought Conditions in 2006" was produced, and Dr. Lubben presented it at Nebraska's Climate Assessment and Response Committee meeting on August 22, 2006.
- Ya Ding attended the American Agricultural Economics Association Annual Meeting in Long Beach, CA, July 23-26, 2006.
- Ya Ding received certification for the Institutional Review Board (IRB) process.
- The subcontract to the University of Colorado for Dr. Chuck Howe's participation was finalized during the quarter.
- A literature review was undertaken, as well as an initial investigation regarding economic impact estimations that have been completed. Discussions also took place with researchers at the National Climatic Data Center (NCDC) in North Carolina who have been interested in collecting economic impact estimates from a variety of natural hazards, including droughts.

Accomplishments during the first quarter of 2007 (January-March):

- The economic impacts from drought during 2006 were included within an annual report of drought impacts for 2006 presented at the American Meteorological Society's annual meeting in San Antonio, TX, on January 16.
- Michael Hayes attended a workshop on the climate impact on tourism hosted by the Western Water Assessment held in Boulder, CO, January 23-24.
- On March 28, Ding, Hayes, Woudenberg, and Dr. Karina Schoengold met to discuss next steps related to the project.
- The review of literature and completed economic estimates continued, as did the discussions with NCDC.

B. Summary of findings, including their potential or actual implications for efforts to develop applications, methods, and science-based decision support capacity/systems and to foster sustainable resource management and vulnerability reduction. *(Limit to two pages)*

During the first nine months of the grant, the investigators have basically gathered information relevant for the project. One finding, although not unexpected, is that economic impact data for all sectors is difficult to find and often incomplete or misleading. Another realization is that connecting information or data directly to drought conditions has been very difficult. The investigators have struggled to define drought in terms of the impacts and sectors involved.

C. List of any reports, papers, publications or presentations arising from this project; please send any reprints of journal articles as they appear in the literature. Indicate whether a paper is formally reviewed and published. *(No text limit)*

1. Chuck Howe and Chris Goemans put together a set of guidelines important for the investigators involved in this project. These guidelines have formulated an approach the investigators will take. This document is called "A Strategy for Economic Drought Impact Measurement".

2. Ya Ding, with some assistance from Prabhakar Shrestha, has put together an annotated bibliography for the investigators including a wide variety of documents related to the economic impacts resulting from droughts.

3. Ya Ding developed a document that provided an overview of the drought vulnerable sectors for Nebraska. This document details the position of these sectors within the Nebraska economy, as well as what is known about the recent economic impacts of drought on these sectors in the state. This document will provide the initial basis for follow-up to provide more detail about the economic impacts of drought on the Nebraska economy. Similar documents will be produced for both Colorado and New Mexico.

D. Discussion of any significant deviations from proposed workplan (e.g., shift in priorities following consultation with program manager, delayed fieldwork due to late arrival of funds, obstacles encountered during the course of the project that have impacted outcome delivery). *(Limit to one paragraph)*

E. Where appropriate, describe the climate information products and forecasts considered in your project (both NOAA and non-NOAA); identify any specific feedback on the NOAA products that might be helpful for improvement. (bulleted response)

The weekly U.S. Drought Monitor product has been valuable in assessments of drought conditions across Nebraska, Colorado, and New Mexico. This product is jointly produced by NOAA Climate Prediction Center and National Climatic Data Center, USDA, and the National Drought Mitigation Center.

III. GRAPHICS: PLEASE INCLUDE THE FOLLOWING GRAPHICS AS ATTACHMENTS TO YOUR REPORT

A. One Power point slide depicting the overall project framework/approach/results to date
B. If appropriate, additional graphic(s) or presentation(s) depicting any key research results thus far
C. Photographs (if easy to obtain) from fieldwork to depict study information (if applicable).

IV. WEBSITE ADDRESS FOR FURTHER INFORMATION (IF APPLICABLE)

V. ADDITIONAL RELEVANT INFORMATION NOT COVERED UNDER THE ABOVE CATEGORIES.